Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Periodic Table Problem Set #2**

*Periodic Trends*

***Draw the trend for ATOMIC RADIUS***

1. Rank each of the following in order of INCREASING atomic radius
2. F, K, Br \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Mg, Na, Cs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Os, Ni, Fe \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Rank each of the following in order of DECREASING atomic radius
6. Cl, Br, Ga \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Ne, Rn, Pb \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Ca, Rb, C \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Draw the trend for IONIZATION ENERGY***

1. Rank each of the following in order of INCREASING ionization energy
2. O, S, Ge \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. C, Pb, F \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Be, Ba, B \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Rank each of the following in order of DECREASING ionization energy
6. Al, P, Ag \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Cl, Cu, Au \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Te, I, Xe \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Draw the trend for ELECTRONEGATIVITY***

1. Rank each of the following in order of INCREASING electronegativity
2. V, Y, O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Na, K, Ne \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Fr, Ca, Co \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Rank each of the following in order of DECREASING electronegativity
6. As, Se, Sn \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Xe, Ru, Hf \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Sb, N, He \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Identify each element as a metal, metalloid, or nonmetal.
   1. Fluorine \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Germanium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Zinc \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Phosphorus \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. Lithium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. Give two examples of elements for each category:
    1. Noble gases \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    2. Halogens \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    3. Alkali metals \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    4. Alkaline earth metals \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. Circle the atom in each pair that has the largest atomic radius.
    1. Al or B
    2. S or O
    3. Br or Cl
    4. Na or Al
    5. O or F
    6. Mg or Ca
12. Is it easier to form a positive ion with an element that has a high ionization energy or an element that has a low ionization energy? Explain.
13. Use the concept of ionization energy to explain why sodium forms a +1 ion (Na+) but magnesium forms a +2 ion (Mg+2).
14. What happens to ionization energy as you go down a group on the periodic table? Explain your answer.
15. What happens to ionization energy as you go across the periodic table? Explain your answer.
16. Identify the most and least electronegative groups (families) of elements in the periodic table.

**Introduction to Electron Shielding**

FIGURE 1: “**Bohr Diagrams**” of boron, carbon and nitrogen:

nuclear

charge = +5

nuclear charge = +6 nuclear charge = +7

**Boron** **Carbon** **Nitrogen**

Because the nucleus is positively charged, it exerts an attractive force on the electrons. However, the three electrons in boron’s outer energy level do not feel the full +5 attraction from the 5 protons in boron’s nucleus. Before the +5 attraction gets to the outer energy level it gets partially cancelled (or “**shielded**”) by the two electrons in the first energy level. The two electrons in the first energy level weaken the attractive force by two. Therefore to the outer energy level it only “feels” like a +3 charge rather than a +5 charge from the nucleus.

Consider the diagram of carbon. An electron in the outer energy level only “feels” a charge of +4 coming from the nucleus because the two electrons in the first energy level shield two of the positive charges from the nucleus.

# **Critical Thinking Questions**

1. How large is the charge that the second energy level of nitrogen “feels” from the nucleus?
2. How many energy levels does aluminum have? How many electrons should be in each energy level?
3. Draw a Bohr diagram for aluminum similar to those above. Label the nucleus charge.
4. Explain why the second energy level of aluminum only feels a +11 attraction instead of a +13 attraction from aluminum’s electrons.
5. How large is the charge that the third energy level of an aluminum atom “feels” from the nucleus?